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Behavioral Facilitation: A Cognitive Model of Individual Differences in Approach Motivation

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Approach motivation consists of the active, engaged pursuit of one's goals. The purpose of the present three studies ($N = 258$) was to examine whether approach motivation could be cognitively modeled, thereby providing process-based insights into personality functioning. Behavioral facilitation was assessed in terms of faster (or facilitated) reaction time with practice. As hypothesized, such tendencies predicted higher levels of approach motivation, higher levels of positive affect, and lower levels of depressive symptoms and did so across cognitive, behavioral, self-reported, and peer-reported outcomes. Tendencies toward behavioral facilitation, on the other hand, did not correlate with self-reported traits (Study 1) and did not predict avoidance motivation or negative affect (all studies). The results indicate a systematic relationship between behavioral facilitation in cognitive tasks and approach motivation in daily life. Results are discussed in terms of the benefits of modeling the cognitive processes hypothesized to underlie individual differences motivation, affect, and depression.

Keywords: personality, behavioral facilitation, reaction time, motivation, affect, depression

Positive affect and behavioral facilitation are frequently thought to be outputs of the same approach-motivated system (Davidson, 1999; Lang, 1995; Panksepp, 1998). In support of this point, approach-linked variables are associated with both higher levels of positive affect and higher levels of behavioral facilitation over time. For example, dopamine injections in the rat are both hedonically rewarding (as established by self-stimulation and place preference studies) and linked to increased motoric activity (Panksepp, 1998; Wise & Bozarth, 1987). In studies with humans, there is a surprisingly strong relationship between diurnal variations in activity levels and diurnal variations in positive affect (Watson, Wiese, Vaidya, & Tellegen, 1999). That is, as activity level increases, so does positive affect, and visa versa. Such results establish a potentially close link of positive affect to behavioral facilitation.

A wider survey of multiple literatures reveals just how promising this cognitive–behavioral model is (Robinson & Tamir, 2008). When individuals are engaged in goal pursuit, they not only perform better over time, but also experience higher levels of positive affect, flow, and creativity (Csikszentmihalyi, Abuhamdeh, & Nakamura, 2005). In another literature, it has been shown that "action-oriented" individuals, relative to "state-oriented" individuals, vigorously pursue task-defined goals and this vigorous pursuit is associated with benefits to both task performance and positive affect (Kuhl, 2000). In the social psychology literature, manipulations of positive affect have been shown to facilitate subsequent behavioral responding (Ashby, Isen, & Turken, 1999; Wilkowski & Robinson, 2006) and manipulations of activity level are causal in increasing subsequent levels of positive affect (Pronin & Wegner, 2006; Thayer, 2001).

Clinical considerations support this close potential link of behavioral facilitation to both approach motivation and positive affect. Depression has been psychometrically linked to lower levels of approach motivation and positive affect (Watson, 2000). Depressed individuals have also been shown to exhibit deficits in physical activity, both in general terms and in specific cognitive tasks (Sobin & Sackeim, 1997). Degenerative movement-related disorders, such as Parkinson's disease, are highly comorbid with depression (Lieberman, 2006) and effective treatments for such disorders mitigate both movement-related symptoms and levels of comorbid depression (Rempello, Chiechio, Raffaele, Vecchio, & Nicoletti, 2002). Bilateral damage to the lateral frontal cortex, linked to reduced levels of task focus and goal-persistence (Miller & Cohen, 2001), often results in symptoms such as lethargy and inaction that are more or less defining features of major depression (Saint-Cyr, Bronstein, & Cummings, 2002).

Connections involving regions of the basal ganglia and the prefrontal cortex facilitate both procedural learning (Lieberman, 2000) and positive affect in response to incentives (Knutson & Wimmer, 2007). Regions of the basal ganglia are especially high in dopamine receptors (Knutson & Gibbs, 2007) and dopamine

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function, in turn, has been linked to individual differences in approach motivation and positive affect (Depue & Collins, 1999). Thus, there is converging support for the idea that at least one important neural basis for individual differences in approach motivation is likely reliant on a subcortical structure that facilitates behavioral activation and positive affect in response to incentives (Knutson & Gibbs, 2007; Knutson & Wimmer, 2007). The purpose of the present studies was to build on the multiple findings discussed above (for a fuller review, see Robinson & Tamir, 2008) in developing an implicit cognitive measure of behavioral facilitation that is likely to be of use in understanding individual differences in approach motivation, positive affect, and depression.

An Implicit Measure of Approach Motivation Based on Reaction Time

Self-reports of motivation can be problematic (Freud, 1962; McClelland, 1987), in part because people are often unaware of the motivational forces driving their behavior (Boring, 1953; Horney, 1945). Moreover, self-reported traits correlate with a large variety of cognitive, affective, and behavioral processes (Pytlik Zillig, Hemenover, & Dienstbier, 2002; Werner & Pervin, 1986). Because of this fact, it is often difficult to determine which *specific* processes are responsible for a given correlation between a self-reported trait and an emotional outcome (Gross, Sutton, & Ketelaar, 1998; Matthews & Gilliland, 1999; Robinson, Meier, & Vargas, 2005a). Cognitive methods, by contrast, can isolate and measure specific hypothesized processes, thereby providing process-related insights that are quite ambiguous when self-reported traits are used (Robinson & Compton, 2007).

Motivation can be viewed in terms of a two-process sequence, a suggestion consistent with both cybernetic (Carver & Scheier, 1998; Powers, 1998) and neurocognitive (Carter et al., 1998; Kerns et al., 2004) models of motivated behavior. The first stage is concerned with recognizing motivation-relevant stimuli. Depending on the stimuli involved, brain areas such as the amygdala, the insula, the nucleus accumbens, or the anterior cingulate cortex can be involved in this *monitoring stage* of motivation (Lieberman, 2003). The second stage is involved in regulating behavior in support of task-defined goals, particularly over time (Duncan, 2005; Miller & Cohen, 2001). This second *operating stage* of motivation is linked to regions of the prefrontal cortex, particularly the dorsolateral prefrontal cortex (Knight & Stuss, 2002).

We have previously linked speed to recognize threats to individual differences in avoidance motivation and negative affect in everyday life (e.g., Robinson, Vargas, Tamir, & Solberg, 2004). Such findings likely involve the monitoring stage that is responsible for recognizing motivation-relevant (in this case, threatening) stimuli as they occur. However, operationally parallel measures involving speed to recognize rewarding stimuli have not proven useful in predicting approach motivation and positive affect in everyday life (e.g., Robinson, Solberg, Vargas, & Tamir, 2003). Thus, it appears that a different process-related strategy is necessary to cognitively model individual differences in approach motivation.

Several theories and sources of data converge on a behavioral facilitation model of approach motivation and its correlates (Robinson & Tamir, 2008). In the present studies, then, we sought to cognitively model such behavioral facilitation processes in choice reaction time (RT) tasks. Tasks of this type have proven productive in understanding individual differences in appraisal, motivation, and self-regulation in many previous studies (for reviews, see Robinson & Compton, 2007; Robinson & Neighbors, 2006). Thus, we had reason to expect some success in the present endeavor. Although the psychology of button-presses has recently been disparaged in the social-personality psychology literature (Baumeister, Vohs, & Funder, 2007), this critique is misplaced to the extent that predictive validity is established (Robinson, 2007). Simply stated, outcomes of interest to the social-personality literature are dependent on basic mental processes and thus modeling such processes should have considerable predictive potential.

Overview of Studies

To measure behavioral facilitation, we administered several choice tasks (e.g., vegetable vs. fruit: Studies 2 & 3) while assessing reaction time. To define behavioral facilitation, we contrasted early performance with later performance, in the latter case after some initial practice. If behavioral facilitation is indeed a core process of approach motivation (Robinson & Tamir, 2008), then higher levels of facilitation in choice RT should predict approach motivation (positively), positive affect (positively), and depressive symptoms (negatively) in daily life. Three studies involving multiple tests of these hypotheses were conducted.

Hypothesized relations between behavioral facilitation and approach motivation were primarily examined in Studies 2 and 3. Hypothesized relations between behavioral facilitation and positive affect were examined in all studies. In Study 1, positive affect was assessed by informant reports. In Study 2, it was assessed by self-reports and observations of behavior during an interview. In Study 3, we sought to link behavioral facilitation to positive emotional experiences in daily life. Finally, predictions involving depressive symptoms were assessed by self-report in Study 1 and by observer report in Study 2.

For the sake of discriminant validity, we also examined two secondary questions. Our reading of multiple literatures led us to believe that our implicit measure of behavioral facilitation might be independent of the person's self-reported traits (McClelland, 1987; Robinson & Compton, 2007; Schultheiss & Pang, 2007). For purposes of establishing this point, Study 1 also administered self-reported traits of the Big 5 model (Goldberg, 2003) and self-reported traits purported to assess approach and avoidance motivation (Carver & White, 1994). To the extent that individual differences in behavioral facilitation do not correlate with these self-reported traits, but do predict the outcome measures, discriminant validity would be established.

Most theories of approach and avoidance motivation contend that they are independent, reflecting different neural, affect-related, and behavioral processes (e.g., Cacioppo, Gardner, & Berntson, 1999; Gray, 1987; Watson et al., 1999). For this reason, we hypothesized that individual differences in behavioral facilitation would predict approach motivation and positive affect, but not avoidance motivation and negative affect. On the other hand, depressive states have been linked to low levels of approach motivation (e.g., Tomarken & Keener, 1998) and, for this reason, we hypothesized an inverse relation between behavioral facilitation and such states.

Study 1

We examined potential relations between the implicit measure of behavioral facilitation and several outcome variables that have been linked to approach motivation in previous studies. Approach motivation has been linked to optimism concerning future events (Scheier & Carver, 1985) and we assessed such perceptions in the present study. Approach motivation has been linked to perceptions of making progress toward important long-term goals (Elliot & Thrash, 2002) and we assessed such perceptions as well. Approach motivation has been linked to lower levels of depression (Davidson, 1999) and we assessed recent symptoms of anhedonic depression to examine this possible correlate. Finally, approach motivation has been linked to individual differences in positive affect. In Study 1, this prediction was assessed in terms of informant reports of positive affect, which have been shown to be reliable and valid in previous studies reported in the literature (Funder, 1995).

If behavioral facilitation is indeed a core aspect of approach motivation (Robinson & Tamir, 2008), then higher levels of behavioral facilitation, measured implicitly, should predict (a) greater optimism concerning the future, (b) higher perceptions of progress toward important long-term goals, (c) lower levels of anhedonic depression, and (d) higher levels of informant-reported positive affect. For the sake of discriminant validity, we also assessed pessimism concerning future negative events and informant reports of negative affect. If we are correct that behavioral facilitation taps individual differences in approach motivation, but not avoidance motivation, then behavioral facilitation scores should not predict the latter outcome variables. Finally, it was of interest whether the behavioral facilitation measure would correlate with self-reported traits. Based on previous findings of ours (e.g., Robinson, 2004) and others (e.g., McClelland, 1987), we did not expect such relations.

Method

Overview

One important goal of all three studies was to make a case for the dispositional nature of the findings relative to the potential influence of transitory mood states or order effects involving the measures. To accomplish this goal, all studies assessed behavioral facilitation in an initial task and assessed the other outcome measures at a later time, typically weeks later. In Study 1, multiple weeks separated the assessment of behavioral facilitation and the outcome measures, which themselves were collected at different times during a semester.

Participants

Participants were 112 (77 female) undergraduates from the University of Illinois, Urbana-Champaign, who completed the measures as a class requirement. Because the measures were completed in different sessions, the exact number of participants involved in each analysis varied somewhat, but always included at least 98 individuals.

Assessing Behavioral Facilitation

Task. Participants completed 7 choice RT blocks, each involving a distinct set of stimuli and distinct category end-points, for a total of 210 trials. The blocks were presented in an invariant order, but particular stimuli were randomly assigned to trial order for each participant. The blocks were ordered as follows: not animal (e.g., *floor*) versus animal (e.g., *mouse*), no blame (e.g., *baldness*) versus blame (e.g., *murder*), no threat (e.g., *stench*) versus threat (e.g., *knife*), neutral (e.g., *method*) versus positive (e.g., *health*), neutral (e.g., *method*) versus negative (e.g., *snake*), feminine (e.g., *sensitive*) versus masculine (e.g., *forceful*), and not intense (e.g., *quiet*) versus intense (e.g., *loud*).

For each block, participants were told to press the 1 key if the stimulus better matched the first category mentioned above (e.g., a "not animal" word), but to present the 9 key if the stimulus better matched the second category mentioned above (e.g., an "animal" word). Instructions indicated that we were interested in both speed and accuracy. To support the accuracy criterion, errors (which were infrequent: $M = 6.31\%$) were penalized with a 1500-ms visual error message. Following correct answers, there was a 150-ms blank delay.

Scoring reaction time. We adopted standard procedures for scoring reaction time (Robinson, 2007). Inaccurate trials were deleted. Then, to reduce the skew typical of RTs, we log-transformed them. Finally, to reduce the undue influence of particularly short or long (log-transformed) times, we replaced them with 2.5 *SD* outlier values.[1]

Scoring behavioral facilitation. Approach motivation is thought to facilitate processing in relation to one's current goals (Carver & Scheier, 1998). In RT tasks, facilitated processing of this type should be reflected in faster performance over time, regardless of the specific task under consideration, even if it relates to the threat versus no threat distinction of Study 1 (Robinson & Tamir, 2008). To define behavioral facilitation in this general manner, multiple block distinctions were used, baseline performance was removed from consideration, and facilitation effects were calculated in a manner independent of block content.

In more specific terms, we subdivided each block in half, thus contrasting *early* (here, Trials 1–15) versus *late* (here, Trials 16–30) performance, the latter set of trials particular to performance in each block following some initial practice. We then created average early and late scores by averaging across relevant performance means from each of the 7 blocks. We predicted that participants would be faster later in the task, a pattern that would comport with prior data (Sanders, 1998). A one-way ANOVA confirmed this prediction in that participants were faster in their categorization performance late ($M = 741$ ms) relative to early ($M = 782$ ms) in the blocks, $F(1, 111) = 71.30$, $p < .01$.

In quantifying behavioral facilitation as an individual difference variable, we sought to define it independently of speed early in the

[1] There is no one outlier replacement procedure that is consistently used in the cognitive psychology literature (Ulrich & Miller, 1994). Accordingly, we emphasize the importance of using consistent outlier replacement procedures across studies. We have, for several years now, used 2.5 *SD* outlier replacement procedures, which we believe to be a compromise between outlier replacements that are too liberal or too conservative (Robinson, 2007). It is worth noting, though, that findings would be virtually identical if we had used 3 *SD* outlier replacement procedures. For example, behavioral facilitation scores based on 2.5 *SD* versus 3 *SD* outlier replacements were correlated at $r = .98$ in Study 1 and predicted results were identical as well.

tasks (Ackerman, 1988). To accomplish this goal, we performed a simple regression in which the early log-latency mean was entered in the prediction of the late log-latency mean, following which we calculated residual scores. The resulting residual scores were necessarily correlated with late, but not early, performance and assessed the extent to which the individual's facilitation in the task was either more pronounced (negative residual scores) or less pronounced (positive residual scores) than we could expect based on early log-latency performance.

We assessed the reliability of the behavioral facilitation measure in the following manner. We performed 105 regressions in which early log speed (averaged across the 105 early trials) was entered as a predictor of each of the 105 late trials. We used the regression results to create 105 late residual scores, with early speed systematically removed. To determine the reliability of behavioral facilitation across trials, we then computed an alpha coefficient across these trial-specific residual scores. Alpha was .77. Thus, behavioral facilitation, as defined here, is a reliable individual difference variable that is manifest independently of block content.

Potential Correlates of Behavioral Facilitation

Traits of the Big 5 model. We were interested in possible relations between behavioral facilitation and the traits of the Big 5 model, namely extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. Toward this end, we administered Goldberg's (1992) 100-item scale involving unipolar markers for each of the five factors. Participants were asked to indicate the extent to which each marker described their personality (1 = extremely inaccurate; 5 = extremely accurate). Alphas varied from .84 to .92 for extraversion ($M = 2.91$; $SD = 0.53$), agreeableness ($M = 3.35$; $SD = 0.39$), conscientiousness ($M = 3.15$; $SD = 0.38$), neuroticism ($M = 2.50$; $SD = 0.42$), and openness to experience ($M = 3.27$; $SD = 0.38$).

Self-reports of BAS and BIS. In Gray's (1987, 1990) influential neurocognitive theory, the Behavioral Activation System (BAS) is thought to facilitate responses to reward and nonpunishment and underlie impulsive behaviors. By contrast, the Behavioral Inhibition System (BIS) is thought to facilitate responses to punishment and nonreward and underlie tendencies toward anxiety. Although debate exists as to the exact processes involved in BAS and BIS and indeed the best trait measures of these constructs (Smillie, Pickering, & Jackson, 2006), the most frequently used trait scales in this literature were created by Carver and White (1994). Accordingly, we administered the Carver and White scales here. Participants were asked to indicate the extent (1 = very false of me; 4 = very true of me) to which 13 statements thought to reflect trait differences in BAS (e.g., *I go out of my way to get things I want*), as well as 7 statements thought to reflect trait differences in BIS (e.g., *I worry about making mistakes*), characterize the self in general terms. Scale scores of BAS ($M = 2.14$; $SD = 0.33$; $\alpha = .88$) and BIS ($M = 1.96$; $SD = 0.51$; $\alpha = .72$) were relatively independent, $r = -.17$, $p > .05$.

Optimism and pessimism concerning future events. We hypothesized that the behavioral facilitation measure would predict optimism concerning future positive events, but not pessimism concerning future negative events. To assess such predictions, participants were asked to indicate the likelihood (1 = extremely unlikely; 7 = extremely likely) that 10 positive events (e.g., *you will get the best grade on a paper or exam in class within the next few months*; $\alpha = .70$; $M = 2.70$; $SD = 0.78$) and 19 negative events (e.g., *you will have a heart attack before the age of 50*; $\alpha = .87$; $M = 1.14$; $SD = 0.68$) would befall them in the future. Consistent with views suggesting some independence of optimism and pessimism (Marshall, Wortman, Kusulas, Hervig, & Vickers, 1992), the correlation between optimism for future positive events and pessimism for future negative events was not significant, $r = .14$, $p > .10$.

Goal progress. We hypothesized that the behavioral facilitation measure would predict perceived progress toward important life goals. To assess this prediction, participants were asked to indicate the extent (1 = not sure I will ever reach this goal; 5 = close to reaching this goal) to which they had made progress toward three important goals, listed by the participant, during the past month ($\alpha = .64$; $M = 2.97$; $SD = 0.41$).

Anhedonic depression. Depression has been linked to lower levels of approach motivation in previous research (e.g., Davidson, 1999). Accordingly, we hypothesized that behavioral facilitation would be inversely related to recent experiences of depression. To examine this possibility, participants were asked to indicate the extent (1 = not at all; 5 = extremely) to which they had experienced different symptoms indicative of high (e.g., *felt really slowed down*) and low (e.g., *felt really "up" or lively*) levels of anhedonic depression during the previous week (Watson & Clark, 1991; $\alpha = .94$; $M = 1.87$; $SD = 0.64$).

Informant ratings of positive and negative affect. The behavioral facilitation measure was hypothesized to predict positive affect, but not negative affect. To assess this set of predictions in Study 1, we obtained informant reports of positive and negative affect. Participants listed six informants that knew them reasonably well. We contacted the informants and received 4.32 informant responses per participant. Informants were asked to estimate the percentage of waking time (1 = 0%; 8 = 100%) that the participant in question typically experiences nine markers of positive affect (e.g., *happy*; $\alpha = .77$; $M = 4.42$, $SD = 0.58$) and six markers of negative affect (e.g., *sad*; $\alpha = .55$; $M = 3.15$; $SD = 0.47$). Such reports were inversely correlated, but not to a strong degree, $r = -.27$, $p < .01$.

Results

Correlations Involving the Outcome Measures

For purposes of clarity, we recoded the behavioral facilitation measure such that higher values represented higher levels of behavioral facilitation (i.e., -1^* residual late performance, z-scored). The recoding procedures will not affect significance values, but will render the direction of the correlations more easily interpretable. As hypothesized, higher levels of behavioral facilitation were predictive of optimism concerning the probability of future positive events, $r = .23$, $p < .05$, but were not predictive of pessimism concerning the probably of future negative events, $r = .02$, $p > .85$. Behavioral facilitation scores also predicted perceptions of goal progress, $r = .21$, $p < .05$, such that higher levels of behavioral facilitation were associated with greater perceptions of progress toward important goals. Consistent with expectations, there was an inverse relationship between behavioral facilitation and recent experiences of anhedonic depression, $r = -.20$, $p <$

.05. Finally, it was the case that behavioral facilitation scores predicted informant ratings of positive affect, $r = .19$, $p < .05$, but did not predict informant ratings of negative affect, $r = .00$, $p > .95$. In sum, all hypotheses were supported.

Potential Correlations Involving the Trait Variables

Self-reported and implicit measures of personality are often, if not typically, unrelated (for a review, see Robinson & Neighbors, 2006). This was the case here. The implicit measure of behavioral facilitation was uncorrelated with the traits of the Big 5 model, whether pertaining extraversion, $r = .06$, $p > .50$, agreeableness, $r = -.06$, $p > .50$, conscientiousness, $r = -.15$, $p > .10$, neuroticism, $r = .08$, $p > .40$, or openness to experience, $r = .03$, $p > .75$. The implicit measure of behavioral facilitation was also independent of trait differences in BAS, $r = -.04$, $p > .65$, and BIS, $r = -.02$, $p > .85$. Of further note, relations between the implicit measure and optimism, goal progress, and anhedonic depression remained significant when *all* seven of the trait variables were simultaneously controlled in multiple regressions, ps $< .05$. Although the implicit measure did not significantly predict informant reports of positive affect with all trait variables controlled, $p < .15$, the general point is that behavioral facilitation tendencies appear to provide unique insights into individual differences in approach motivation.[2,3]

Discussion

Robinson (2004; 2007) has reviewed evidence for the idea that implicit measures of personality are largely if not typically independent of self-reported measures of personality. This view was substantiated here with a novel measure of behavioral facilitation, thought to reflect continued engagement with task-defined goals. The behavioral facilitation measure was reliable, but did not correlate significantly with any of the self-reported traits of the Big 5 model or with trait scales designed to tap BAS and BIS function. Thus, the cognitive modeling of behavioral facilitation over time provides unique insights into a person's level of approach motivation.

We hasten to add that self-report measures of personality have considerable utility, even in relation to relatively objective outcomes such as achievement, health, and behavior (Ozer & Benet-Martinez, 2006). Still, the typically inconsistent relations between implicit and self-reported measures of personality, along with the utility of each in predicting behavioral and affective outcomes (Robinson & Compton, 2007; Schultheiss & Pang, 2007; Spangler, 1992), does suggest that an open-minded consideration concerning the potential utility of implicit measures of personality is likely to greatly enrich our understanding of personality processes and outcomes (McClelland, Koestner, & Weinberger, 1989; Robinson, 2007).

In this spirit, the present results indicate that individual differences in behavioral facilitation appear to have utility in understanding individual differences in approach motivation. Along these lines, we found that the behavioral facilitation measure predicted individual differences in optimism concerning the future, recent experiences of anhedonic depression, and informant ratings of positive affect. In the latter case, we view it likely that the goal-directed processes tapped by behavioral facilitation are apparent to others, thus leading others to conclude that the individual is high in the sorts of engagement processes seen to be characteristic of high levels of approach motivation (e.g., Depue & Collins, 1999).

The significant correlations involving the implicit measure were not large and in fact were quite moderate in Study 1. However, we do view the significant correlations as theoretically important. We demonstrated that such correlates were independent of self-reported personality traits. Moreover, the behavioral facilitation measure did not ask individuals to report on their dispositional tendencies toward approach motivation or affect at all. Thus, the correlations reported cannot be due to potential item overlap issues that can be a source of concern in understanding relations among self-report measures (Gross et al., 1998).

Finally, we suggest that implicit measures are useful to probe the underlying motivational processing system thought to give rise to experiences of positive affect (Depue & Collins, 1999; Watson et al., 1999). Specifically, to the extent that one specifies a processing model in cognitively tractable terms, cognitive processing paradigms can be designed to assess the validity of it (Robinson, 2007; Robinson & Compton, 2007). In the present context, it is suggested that individual differences in behavioral facilitation are reflective of individual differences in approach motivation and we were able to provide systematic support for this theoretical model. We were also able to show an important dissociation, such that behavioral facilitation scores were predictive of optimism and positive affect, but not pessimism and negative affect. We sought to extend evidence for this implicit processing model in two further studies.

Study 2

In addition to conceptually replicating Study 1, we sought to extend our knowledge of the correlates of behavioral facilitation. First, it was deemed useful to assess behavioral facilitation in a different set of choice RT blocks, thereby supporting the idea that the correlates of behavioral facilitation can be found quite inde-

[2] Our theoretical framework emphasizes behavioral facilitation rather than tendencies toward sloppy or inaccurate responding with some initial practice. In support of this view, there were no hints of speed-accuracy tradeoffs concerning the behavioral facilitation measure. For example, in a meta-analysis of cognitive data from all studies, we found that there was no systematic relation between speed and accuracy late in the choice RT tasks, $r = .02$, $p > .60$. Thus, we conclude that the implicit measure assessed here is related to behavioral facilitation with practice rather than to late-task biases favoring speed over accuracy.

[3] To quantify individual differences in behavioral facilitation, we removed variance related to early performance. However, we did not report whether there were correlations between early log-latency performance and the dependent measures assessed in the studies. To examine this question, we correlated early log-latency means with the dependent measures reported in Studies 1-3. There were only two significant correlations along these lines and both involved the go/no go task of Study 2. Because such correlations are likely dependent on method factors – that is, the common reliance on RT measurement – the more general point is that early performance had few implications for motivation, affect, or depression in the studies. Because this was quite generally true, we conclude that the correlates of behavioral facilitation cannot be ascribed to tendencies to be either fast or slow in initial performance in cognitive tasks.

pendent of the content-related categories involved. Second, we sought to extend the idea that behavioral facilitation is a predictor of state-related experiences of positive affect. Toward this end, Study 2 administered a laboratory interview designed to induce mixed states of positive and negative emotion. We then examined the question of whether the behavioral facilitation measure would predict higher levels of positive affect following the interview.

Third, we sought to follow up on the informant results of Study 1. Toward this end, we videotaped interviews and then asked observers to rate the extent to which the participant displayed positive emotions, negative emotions, and depressive symptoms during the interview. Prior studies have shown that observer-reports of personality are reliable (Funder, Furr, & Colvin, 2000), valid (Funder, 1995), and particularly informative concerning the correlates of implicit measures of personality (e.g., Asendorpf, Banse, & Mücke, 2002; Spalding & Hardin, 1999). In the present context, it was hypothesized that higher levels of behavioral facilitation would be predictive of observer reports of positive affect and depressive symptoms, but not observer reports of distress-related negative affect, potentially replicating Study 1 in relation to such nuanced predictions.

Another goal of Study 2 was to link individual differences in behavioral facilitation to a second implicit measure designed to assess what may be termed the monitoring component of approach motivation. Monitoring processes are those that are responsible for assigning affective valence to events as they occur (Moors & De Houwer, 2001; Rolls, 1990). To examine such front-end processes, we used a go/no go task that has been extensively validated in previous studies of ours (Robinson et al., 2005a; Tamir, Robinson, & Clore, 2002; Tamir, Robinson, & Solberg, 2006). If our analysis is correct, individual differences in behavioral facilitation should be linked to better monitoring for rewarding stimuli, but not punishing stimuli.

Method

Overview, Participants, and Procedures

As in Study 1, procedures sought to temporally separate the implicit measures and the outcome measures, thereby better supporting the dispositional nature of the findings. Accordingly, participants in Study 2 performed the implicit tasks in a first computerized session. They were then invited to participate in a second interview session at least one week later. Participants in Study 2 consisted of a sample of 51 (41 female) undergraduates from the University of Illinois, Urbana-Champaign, who were monetary compensated ($20) for full compliance with the research protocol.

Procedures for the cognitive tasks were identical to those in Study 1, in that they involved RT performance on a personal computer within a private cubicle. In Study 2, however, participants completed two cognitive tasks, the first designed to assess monitoring processes related to rewards and punishments and the second designed to measure behavioral facilitation. Subsequent to the completion of these cognitive tasks, participants were scheduled for a second session at least 1 week later.

Interviews were individually conducted during the second session of the study, which consisted of a "mental health" interview lasting 5–10 minutes (Spalding & Hardin, 1999). Experimenters asked a series of 9 scripted questions, each of which required 2–3–sentence answers. Three of the 9 questions involved events that are mildly rewarding for most people (e.g., "describe a time in the past year when you went on a trip") and the interviewer was encouraged to adopt a cordial, interested demeanor. The other 6 of the 9 questions focused on difficulties and negative emotional experiences (e.g., "describe a time in the past when you felt dissatisfied with everything"). The interview, then, was designed to induce both positive and negative emotions. Interviews were videotaped for later coding purposes.

Assessing Behavioral Facilitation

Task. In Study 2, participants performed 4 choice RT blocks, each involving a distinct set of stimuli and category endpoints, for a total of 224 trials. The blocks were again presented in an invariant order to insure that the stimulus context was constant across participants. The blocks were ordered as follows: not me (e.g., *them*) versus me (e.g., *mine*), feminine (e.g., *emotional*) versus masculine (e.g., *rational*), vegetable (e.g., *broccoli*) versus fruit (e.g., *banana*), and unpleasant (e.g., *dirt*) versus pleasant (e.g., *smile*).

For each categorization block, participants were asked to press the 1 key if the stimulus better matched the first category mentioned above (e.g., a "vegetable" word), but to press the 9 key if the stimulus better matched the second category mentioned above (e.g., a "fruit" word). As in Study 1, we suggested that both speed and accuracy were important. As in Study 1, errors were relatively infrequent ($M = 4.50\%$). Again, following correct responses, there was a 150-ms blank screen. By contrast, following incorrect responses, there was a 1500-ms visual error message designed to encourage a high degree of accuracy in the task.

Scoring behavioral facilitation. Reaction times were scored in a manner identical to Study 1, including log-transformation of RTs and 2.5 *SD* outlier replacements. We then computed log-latency means contrasting early versus late trials, averaged across blocks. As in Study 1, a normative analysis revealed that late performance ($M = 695$ ms) was faster than early performance ($M = 768$ ms), $F(1, 50) = 79.82$, $p < .01$. This result indicates a normative tendency toward behavioral facilitation. Individual differences in behavioral facilitation were quantified in a manner identical to Study 1, with negative (positive) residual scores indicating greater (lesser) behavioral facilitation than could be expected based on early performance. We then calculated the internal reliability of residual scores in a manner parallel to Study 1 and such residual scores proved to be highly reliable, $\alpha = .80$. What this means, concretely, is that individuals displayed consistent tendencies in behavioral facilitation across blocks and trials of the task.

Potential Correlates of Behavioral Facilitation

Monitoring processes. Participants in Study 2 completed a go/no go task designed to assess monitoring processes. We have used variants of this task in many prior studies (e.g., Tamir et al., 2002). In the present study, there were three blocks, each associated with 126 trials. In one block, participants were asked to press the spacebar in response to desirable or wanted objects (e.g., *love*). In another block, participants were asked to press the spacebar in response to undesirable or unwanted objects (e.g., *pain*). Finally, a third block, used for control purposes, asked participants to press the spacebar in response to neutral words (e.g., *sound*).

The go/no go task had a 600-ms response window, meaning that the word disappeared if the participant did not respond during this 600-ms period. This response window has been shown to be sensitive to both response accuracy and response speed (e.g., Robinson, Meier, & Solberg, 2005b), and we therefore sought to examine both accuracy and speed in the present study. Normatively, go accuracy rates were 81.45%, 76.11%, and 56.02% for approach, avoid, and neutral blocks, respectively. Average RTs were 458 ms, 475 ms, and 498 ms for approach, avoid, and neutral blocks, respectively. Overall, these results indicate that it is somewhat easier to categorize rewarding and punishing stimuli relative to neutral stimuli, a fact that likely relates to affective asymmetries in which it is easier to determine the presence rather than the absence of affective connotation (Wenzel & Rubin, 2005). Regardless, by administering the neutral block, we could control for baseline performance, which is critical in purifying such measures in studies of individual difference functioning (Robinson, 2004, 2007).

To quantify processing skills related to reward and punishment monitoring independently of baseline performance, we controlled for performance in the neutral block, and did so separately for means related to reward-accuracy, reward-speed, punishment-accuracy, and punishment-speed. Thus, these dependent measures were all residual scores with neutral performance statistically controlled. For the sake of easy interpretation of the findings, all four residual measures were scored in the direction of better performance. Specifically, accuracy residual scores were unaltered, whereas RT residual scores were recoded such that higher scores indicated greater proficiency than could be expected on the basis of neutral block performance (i.e., -1^* residual RT, z-scored).

Experiences of positive and negative emotion. Following the interview, participants reported on their experience of positive and negative emotion. Specifically, they rated the extent (1 = not at all; 7 = extremely) to which they had experienced 10 markers of positive affect (e.g., *happy*; $\alpha = .88$; $M = 3.95$; $SD = 0.98$) and 10 markers of negative affect (e.g., *sad*; $\alpha = .85$; $M = 1.60$; $SD = 0.60$). There was an inverse correlation between levels of positive and negative affect following the interview, $r = -.46$, $p < .01$.

Observer reports of emotion during interview. Five undergraduate judges watched the videotaped interviews conducted in Study 2. For each interviewee separately, they performed a Q-sort involving 70 cards. Judges were asked to place the 70 cards in 9 piles, from least descriptive (pile 1) to most descriptive (pile 9) of the interviewee in question (Block, 1961). Following convention, we imposed a constraint upon judges such that they had to place cards into piles in a manner that would approximate a normal distribution (e.g., there were more cards in pile 5 than in the other piles). Items were scored according to pile (Block, 1961). Ten of the cards pertained to positive affect (e.g., *seems to enjoy the interview*; $\alpha = .94$; $M = 5.31$; $SD = 1.09$), 10 of the cards pertained to negative affect (e.g., *seems irritated*; $\alpha = .77$; $M = 4.97$; $SD = 0.55$), and 10 of the cards pertained to observed depression (e.g., *seems sad or depressed*; $\alpha = .86$; 4.07; $SD = 0.79$). There were additional observer cards pertaining to constructs—such as masculinity and femininity—that are not relevant to the present predictions.

Observer reports of positive and negative affect were not correlated, $r = .07$, $p > .60$. Judgments of depression were predicted by judgments of positive affect, $r = -.67$, $p < .01$, but not negative affect, $r = .07$, $p > .60$. Such findings are not unanticipated in the context of observer reports of depression, which are likely to emphasize more easily observed behaviors indicative of positive affect relative to less easily observed inferences concerning internal experiences of distress (Funder & Dobroth, 1987). Regardless, we again hypothesized that behavioral facilitation scores would be positively correlated with positive affect, inversely correlated with depression, and unrelated to negative affect.

Results

Reward and Punishment Monitoring

We hypothesized that behavioral facilitation scores would be systematically predictive of reward monitoring, but not punishment monitoring. Consistent with these hypotheses, behavioral facilitation scores were positively correlated with reward-accuracy scores in the go/no go task, $r = .30$, $p < .05$, and with reward-RT scores in the go/no go task, $r = .31$, $p < .05$. By contrast, behavioral facilitation scores did not predict residual scores related to either punishment-accuracy, $r = .08$, $p > .50$, or punishment-RT, $r = .05$, $p > .70$. Thus, Study 2 provides systematic evidence for a link of behavioral facilitation to another measure of implicit approach motivation.

Self-Reported Experiences of Positive and Negative Affect

We further hypothesized that behavioral facilitation scores would predict experiences of positive affect, but not negative affect. Such predictions were supported. Behavioral facilitation scores predicted higher levels of positive affect following the interview, $r = .27$, $p < .05$, but were uncorrelated with levels of negative affect, $r = -.06$, $p > .65$. Thus, Study 2 provides further support for a unique relation of behavioral facilitation processes to positive affect.

Observer Reports of Positive Affect, Negative Affect, and Depression

We finally examined potential relations between behavioral facilitation scores and observer reports of emotionality. Consistent with a broad link of behavioral facilitation to approach motivation and positive affect, such scores predicted observer-reports of positive affect, $r = .41$, $p < .01$, and depressive symptoms, $r = -.28$, $p < .05$, but did not predict observer-reports of negative affect during the interview, $r = .07$, $p > .60$. The results again reinforce the particular link of individual differences in behavioral facilitation to approach motivation and positive affect relative to avoidance motivation and negative affect.

Multiple Regressions

We performed a final set of multiple regressions in which behavioral facilitation, reward-RT, and reward-accuracy implicit measures were entered as simultaneous predictors of the remaining outcome variables. In the regression predicting positive affect following the interview, behavioral facilitation was a significant predictor, $p < .05$, but reward-RT, $p > .50$, and reward-accuracy,

$p > .50$, were not. Behavioral facilitation was also the only significant predictor of displayed positive emotion, $p < .01$, with reward-RT, $p > .30$, and reward-accuracy, $p > .20$, simultaneously controlled. Similar findings were found for displayed levels of depression (behavioral facilitation, $p = .05$; reward-RT, $p > .90$; reward-accuracy, $p > .85$). Thus, it appears that operating processes related to behavioral facilitation over time capture individual differences in approach motivation better than do monitoring processes related to the quick and accurate recognition of rewarding stimuli.

Discussion

Study 2 assessed individual differences in behavioral facilitation in a different task than that used in Study 1. Despite this fact, the pattern of correlates conceptually replicated the results from Study 1. Again, we found that higher levels of behavioral facilitation were predictive of experiences of positive affect, but not negative affect. The conceptual replication of these findings, in Study 2 involving affective experiences following an interview, leads to more confidence in the convergent and discriminant nature of the hypotheses.

Study 2 also replicated Study 1 in relation to observer judgments. In Study 2, we induced emotion in the lab and used judges who did not personally know the participants in question (indeed, although the study was conducted at the University of Illinois, Urbana-Champaign, the videotape ratings were obtained at North Dakota State University). Again, though, behavioral facilitation scores predicted the extent to which observers inferred that the participant was high in positive affect. In sum, we now have evidence across three types of reports (informant reports, self-reports, & reports by naïve observers) for the hypothesis of a systematic relation between individual differences in behavioral facilitation and positive affect.

Depression has been linked to deficient levels of approach motivation (Strauman, 2002; Tomarken & Keener, 1998). From this perspective, we hypothesized that lower levels of behavioral facilitation would be associated with higher levels of depressive symptoms. Study 1 provided support for this idea in relation to self-reports of anhedonic depression and Study 2 provided support for this idea in relation to observer-judgments of depression. Thus, we suggest that cognitive probes of approach motivation, of the present type, may be useful in assessing depressive symptoms and we elaborate on this point in the General Discussion.

The results of Study 2 were also important because we were able to link individual differences in behavioral facilitation to implicit approach motivation in a well-validated go/no go task (Robinson et al., 2005b, 2005a; Tamir et al., 2002, 2006). In fact, we were able to demonstrate links of this type in relation to both accuracy- and RT-based abilities to recognize reward-related stimuli (e.g., *love*, *reward*). By contrast, we found that behavioral facilitation scores did not predict abilities to recognize punishment-related stimuli. On the basis of these results, we again suggest that individual differences in behavioral facilitation are uniquely informative concerning the person's underlying levels of approach motivation and engagement.

Study 3

In addition to conceptually replicating the prior results, Study 3 had an important additional purpose. It is widely thought that dispositional tendencies related to motivation and emotion might be best assessed in daily life, specifically through the use of experience-sampling protocols (e.g., Gable, Reis, & Elliot, 2000). The benefits of experience-sampling protocols are twofold. One, they capture life "as it is lived" rather than retrospected upon (Bolger, Davis, & Rafaeli, 2003; Robinson & Clore, 2002). Second, experience-sampling protocols are useful because they allow one to average reports across multiple specific episodes, thereby insuring that the averaged reports capture dispositional tendencies rather than those that might be particular to a given situation or occasion (Diener & Larsen, 1984; Epstein, 1983).

In the present context, it was hypothesized that behavioral facilitation scores, obtained in a choice RT task, would predict states of approach motivation and positive affect in daily life. To examine this important set of predictions, we asked individuals to carry palm pilot computers for one week and to respond to a randomized set of pages whenever they occurred. If our theory-motivated predictions are correct, behavioral facilitation scores should predict everyday tendencies toward approach motivation and positive affect, while being uncorrelated with everyday tendencies toward avoidance motivation and negative affect.

Method

Overview, Participants, and Procedures

Participants consisted of 95 (58 female) undergraduates from the University of Illinois, Urbana-Champaign. Completion of the initial assessment session was rewarded with extra credit, whereas completion of the experience-sampling protocol was rewarded with $20. In the initial assessment session, participants completed a set of choice-RT blocks used to assess behavioral facilitation, and did so at private computer stations.

Subsequent to this initial assessment session, participants were given palm pilot computers and instructed to carry them for 7 consecutive days. The computers were loaded with six pages per day, occurring at random times from 10 a.m. to 10 p.m. When beeped by the computer, participants were given a total of four minutes to respond. If they did not initiate their response within this 4-minute period, the report was considered missing. Participants were asked to respond to at least five of the six pages per day. For purposes of estimating compliance with the protocol, we replaced more than 35 reports with 35. Of the 35 required reports, the average participant completed 31.71 (90.6%), which is deemed a very good rate of compliance (Bolger et al., 2003).

Assessing Behavioral Facilitation

The choice RT task administered in Study 3 was identical to that administered in Study 2. As in prior studies, errors were relatively infrequent ($M = 8.99\%$). Reaction times in the task were scored as in prior studies, including log-transformation and 2.5 *SD* outlier replacements. Normatively, performance was faster later in the relevant blocks ($M = 606$ ms) relative to earlier in the same blocks ($M = 645$ ms), $F(1, 94) = 113.03$, $p < .01$. Individual differences in behavioral facilitation were quantified in a manner identical to

the prior studies. As in prior studies, the internal reliability of such scores was quite reasonable for an implicit measure, $\alpha = .75$.

Potential Correlates of Behavioral Facilitation

Motivational states in daily life. The palm pilot survey asked participants to characterize their current levels of approach and avoidance motivation when paged. We administered two sets of questions along these lines. First, when paged, participants indicated the extent (1 = not at all; 6 = extremely) to which they found their current situation "rewarding" ($M = 3.07$; $SD = 0.88$) and "threatening" ($M = 1.66$; $SD = 0.67$) in two separate questions. Such perceptions were correlated to a moderate degree, $r = .35$, $p < .01$. Second, participants indicated the extent (1 = not at all; 6 = extremely) to which they were currently "working to get something you want" ($M = 3.37$; $SD = 0.86$) and "trying to avoid something you don't want" ($M = 2.42$; $SD = 0.81$). Again, such perceptions were positively correlated, $r = .45$, $p < .01$. In sum, states of approach and avoidance motivation were moderately correlated, with the positive correlations suggesting that some individuals are generally more motivated than others in daily life. Regardless, we viewed it likely that behavioral facilitation scores would predict approach-motivated states, but not avoidance-motivated states.

Momentary experiences of positive and negative emotion. Participants in Study 3 were also asked to rate the extent (1 = not at all; 6 = extremely) to which they were currently feeling eight positive emotions (e.g., *happy*; $\alpha = .96$; $M = 3.27$; $SD = 0.79$) and nine negative emotions (e.g., *sad*; $\alpha = .95$; $M = 1.60$; $SD = 0.44$). Momentary experiences of positive and negative emotion were largely independent of each other, $r = .06$, $p > .54$, as has been reported in previous studies (e.g., Conner & Barrett, 2005; Robinson et al., 2005a). In the present context, we hypothesized that individual differences in behavioral facilitation would predict everyday experiences of positive affect, but not negative affect.

Results

Approach and Avoidance Motivation in Daily Life

As hypothesized, behavioral facilitation scores were positively correlated with appraisals of momentary life as rewarding, $r = .27$, $p < .01$, but were not correlated with appraisals of momentary life as threatening, $r = .08$, $p > .55$. Further, individuals higher in behavioral facilitation were more likely to indicate that they were approaching desired end-states, $r = .26$, $p < .05$, but there was no relation involving the parallel avoidance motivation item, $r = .06$, $p > .55$. The relation between behavioral facilitation and reward appraisals remained significant when controlling for threat appraisals, $t = 2.62$, $p < .05$, and the relation between behavioral facilitation and approach-motivated states remained significant when controlling for avoidance-motivated states, $t = 2.53$, $p < .05$. The results thus provide further evidence for the approach motivation-behavioral facilitation link.

Positive and Negative Affect in Daily Life

We further hypothesized that behavioral facilitation scores would predict positive, but not negative, daily emotional experiences. This set of predictions was also systematically confirmed. Specifically, individuals higher in behavioral facilitation were also higher in their levels of positive affect in daily life, $r = .27$, $p < .01$. By contrast, there was no relationship of behavioral facilitation to daily experiences of negative affect, $r = .02$, $p > .80$.

Discussion

Study 3 provided opportunities to link behavioral facilitation to momentary states of motivation and emotion in daily life. As hypothesized, higher levels of behavioral facilitation were predictive of higher levels of daily approach motivation and this link was established in relation to two measures, one that targeted the extent to which the current situation was perceived as rewarding and one that targeted the extent to which the individual was engaged in approach-focused goals. By contrast, and consistent with all of the data reported above, there was no link of behavioral facilitation to avoidance motivation. Thus, Study 3 converges on the unique relation of behavioral facilitation to approach motivation.

Of further importance, Study 3 found that individual differences in behavioral facilitation predicted positive emotional states in daily life, but did not predict negative emotional states in daily life. Aside from the fact that these results conceptually replicate the results reported in Studies 1 and 2, we emphasize the importance of these findings in another way. There have been preciously few studies linking implicit processing tendencies to emotional experiences in daily life (for a review, see Robinson & Compton, 2007). The results of Study 3 are therefore particularly important in supporting the point that implicit processing tendencies, irrespective of trait variables (see Study 1), are robust enough to encourage this sort of process-based approach to personality (Robinson, 2007; Robinson & Neighbors, 2006).

General Discussion

Theoretical Background and Summary of Findings

Psychoanalytic (Freud, 1962) and behavioral (Hull, 1943) approaches to motivation diverge in many respects (Westen, 1998). However, both of these classic views of motivation converge on the utility of studying motivation in terms of what people *do* in their interactions with the environment (McClelland, 1987; Pervin, 1994). Motivation, in sum, is something that is thought to facilitate and drive behaviors of a given type and might be best, or at least uniquely, assessed in terms of the behavioral tendencies of the individual (McClelland, 1951, 1987). Furthermore, there are reasons for thinking that the motivational drives of behavior often rely on subcortical structures that may not be directly accessible to awareness (LeDoux, 1996; Panksepp, 1998). From this perspective, too, there are reasons to probe motivation in terms of behavior rather than self-report (McClelland, 1987).

Such considerations are relevant to thinking about approach motivation, which is thought to rely on subcortical structures such as the basal ganglia, responsible for automating behaviors with some initial practice (Yin & Knowlton, 2006). More generally, theories of approach motivation view it as a neurocognitive system responsible for facilitating behavior in relation to an ongoing goal state of the individual (Depue & Collins, 1999; Watson et al., 1999). The purpose of the present studies was to operationally define behavioral facilitation in a cognitively tractable manner. We

reasoned that simple instructions to perform choice RT tasks as quickly as possible would recruit individual differences in approach motivation, which would, in turn, be associated with faster performance over time. If so, our behavioral facilitation measure should predict motivations, behaviors, and experiences presumed to be outputs of the approach motivation system (Lang, 1995; Panksepp, 1998).

Such hypotheses were systematically supported in three studies using different choice tasks and different outcome measures relevant to theories of approach motivation. Multiple findings linked behavioral facilitation in the cognitive tasks to: (a) higher levels of approach motivation, (b) higher levels of positive affect, and (c) lower levels of depression. The findings involving approach motivation were replicated across an implicit task assessing one's ability to link approach goals to stimuli as they occur (Study 2) and to states of approach motivation in daily life (Study 2). The findings involving positive affect were replicated in all studies across both informant-based and self-reported levels of positive affect. The findings involving depressive symptoms were found in relation to recent tendencies toward such symptoms (Study 1) and observer-reports of behavior exhibited during a mental health interview (Study 2). In sum, there was general support for our predictions across measures and studies.

We were also able to support the discriminant validity of our hypotheses. Study 1 found that self-reported traits did not predict behavioral facilitation scores, consistent with the idea that our measure taps implicit tendencies toward approach motivation rather than conscious beliefs concerning one's personality. Another discriminant set of findings was the consistent relation of behavioral facilitation to approach motivation and positive affect, but not avoidance motivation and negative affect. Although such discriminant predictions were secondary rather than primary, they do further support the utility of assessing approach motivation in terms of individual differences in behavioral facilitation. In the discussion that follows, we link our measure to the cognitive literature, revisit the conceptual link of behavioral facilitation to approach motivation, and discuss further potential applications of this cognitive model.

What Is Behavioral Facilitation, Cognitively Speaking?

There is surely some relation of behavioral facilitation, as assessed in the present studies, to the cognitive literature on automaticity and we discuss such potential relations here. A first question is whether behavioral facilitation reflects a bias toward speed, rather than accuracy, with some initial practice. In footnote 2, we note that there was no relation between behavioral facilitation in RT and lesser accuracy rates over time. This set of findings comports with the cognitive literature, which has found that RT-related facilitation with initial practice cannot be linked to biases to respond faster, but inaccurately (Ackerman, 1988; Logan, 1992).

It is also clear from the cognitive literature that our measure of behavioral facilitation should most directly tap the "efficiency" criterion of automaticity, defined as tendencies to perform a task more efficiently with practice (Logan, 1992; Smith & Lerner, 1986). Our measure, by contrast, should not be viewed in terms of other criteria of automaticity, such as unconscious processing or lack of control, particularly as different criteria defining the classic construct of "automaticity" are only loosely coupled at best (Bargh, 1994; De Houwer, 2006).

Further, we suggest that behavioral facilitation should be largely independent of psychometric intelligence or the *g* factor (Jensen, 1998) and data are in support of this point. Specifically, it has been shown that the *g* factor, often conceptualized in terms of fluid intelligence, differentially predicts early task performance in RT relative to later task performance (Ackerman, 1988, 1990). Because we statistically controlled for early task performance in operationalizing behavioral facilitation, we also suggest that our behavioral facilitation measure should be more sensitive to the efficiency of performance over time rather than primarily linked to the *g* factor or fluid intelligence (Ackerman, 1988, 1990).

Revisiting Theories Linking Approach Motivation to Behavioral Facilitation

Many theories propose that positive affect relies on an engaged, goal-directed mode of processing (e.g., Davidson, 1999; Lang, 1995). The emphasis is placed on the person's ongoing goals and cognitive processing is designed to reinforce links between such goals, the present stimuli, and one's behavioral responses (Cohen & Servan-Schreiber, 1992). The consistent application of such goal-directed efforts should promote efficient cognitive skills that better insure the success of one's goals (Watson et al., 1999). One of the side effects of such an effective form of task-directed processing appears to be positive affect (Robinson & Tamir, 2008).

Moreover, it is notable that goal pursuit, whether successful or not, typically "feels good" (Brown & Dutton, 1995). Further, goal pursuit carries with it perceptions of self-efficacy (Bandura, 1989) and "flow" (Csikszentmihalyi et al., 2005). In the present studies, we sought to cognitively model effective goal pursuit within a constrained and controlled task environment. As expected, this measure predicted individual differences in approach motivation and positive affect, providing further support for the goal pursuit-positive affect relation.

Should individual differences in behavioral facilitation predict avoidance motivation and negative affect? We do not think so for two primary reasons. One, there is consistent evidence linking negative affect to involuntary sorts of cognitive processes such as those related to automatic threat orienting (e.g., Öhman, 1997; Robinson, 1998). However, in the present studies, we modeled a voluntary form of automaticity, namely suited to finishing a cognitive task quickly and accurately. Two, fear and anxiety most often arise in connection with irruptive stimuli (e.g., such as the sudden appearance of a big barking dog: Frijda, 1986; Robinson, 1998). However, in the present studies, stimuli were predictable and expected.

For such reasons, we generally suggest that the present processes assessed are those supporting the voluntary goals of the Behavioral Activation System (Gray, 1987; Watson et al., 1999) relative to the involuntary goals of the Behavioral Inhibition System (Gray, 1987; Watson et al., 1999). Indeed, this appeared to be the case in the present studies. Still, it is important to note that depression appears to involve motivational substrates that are quite different from activated negative affect.

In this connection, multiple theories of depression link it to deficient approach motivation (Ingram, Scott, & Siegle, 1999;

Strauman, 2002; Tomarken & Keener, 1998). According to such theories, depressed individuals fail to consistently apply their goals to their current circumstances, resulting in the unfortunate consequence that such goals exert a lesser influence on emotion and behavior (Ingram et al., 1999; Tomarken & Keener, 1998). As a consequence of this withdrawal of self-regulatory resources, the individual is less likely to succeed in achieving his or her goals (Bandura, 1989; Norman & Shallice, 1986). The present implicit measure provides an intriguing glimpse into these cognitive-affective processes associated with depression.

Directions for Future Research

It would seem useful to examine other novel correlates of behavioral facilitation in future studies. In particular, it seems likely that individuals higher in behavioral facilitation might be more successful in reaching approach-related goals, defined in a more objective manner. For example, we would predict that individuals higher in behavioral facilitation might be better able to achieve important long-term goals such as getting good grades in classes or performing well at work. Because the present studies did not measure such long-term behavioral outcomes, this would seem an especially useful direction for further research.

Moreover, although our results highlight the beneficial correlates of behavioral facilitation, some theories have suggested that especially high levels of approach motivation could result in some impulsive behaviors that are approach-related in nature (Gray, 1987; Patterson & Newman, 1993). Thus, it is possible that behavioral facilitation tendencies, too, could be associated with an increased risk of some forms of disinhibited behavior, potentially including instrumental aggression (Crick & Dodge, 1994), impulsive behaviors more generally (Gray, 1987), and/or substance abuse addictions (Wise & Bozarth, 1987).

The present findings are correlational in nature. It is therefore an interesting question whether manipulations of behavioral practice, which would certainly support higher levels of behavioral facilitation (e.g., Sanders, 1998), might be efficacious in boosting levels of implicit approach motivation. Some indirect support for such a possibility comes from the clinical literature, in which it has been shown that training individuals to avoid threats in selective attention tasks appears to have both short-term and long-term benefits in reducing levels of anxiety (MacLeod, Campbell, Rutherford, & Wilson, 2004; Yiend & Mackintosh, 2004). Thus, it is reasonable to think that cognitive tasks of the present type might have value in training higher levels of approach motivation, which might be especially beneficial in relation to some of the cognitive and social deficits associated with depression (Ingram et al., 1999).

Conclusions

We developed a cognitive–behavioral measure assessing the extent to which individuals could automate their performance in relation to a task-defined goal. Consistent with theories linking approach motivation to behavioral facilitation (e.g., Lang, 1995), we found that individuals better able to improve their performance over time were higher in approach motivation, higher in positive affect, and lower in depressive symptoms. On the basis of the present data, we suggest that behavioral facilitation tendencies constitute a novel and important probe of individual differences in approach motivation, which in turn seems likely to be of value in multiple literatures in which approach motivation is a central construct.

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